

PARASITES AFFECTING CNS

(Neurocysticercosis & Coenurosis.)

BY

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Objectives

By the end of this lecture, you will be able to:

- ☐ List parasites that affect CNS.
- ☐ Illustrate morphology & life cycle of *Taenia spp.*
- ☐ Discuss clinical picture, diagnosis & treatment of cysticercosis & coenurosis.

PARASITES CAN AFFECT CNS

Protozoa	Cestoda	Trematoda	Nematoda
<u><i>Acanthamoeba</i> spp.</u>	<i>Echinococcus granulosus</i>	<i>Alaria americana</i>	<i>Angiostrongylus cantonensis</i>
<i>Babesia</i> spp.	<i>E. multilocularis</i>	<i>Paragonimus</i> spp.	<i>Ascaris suum</i>
<i>Balamuthia mandrillaris</i>	<i>Spirometra</i> spp.	<i>Schistosoma mansoni</i>	<i>Baylisascaris procyonis</i>
<i>Entamoeba histolytica</i>	<u><i>Taenia multiceps</i></u>	<i>S. hematobium</i>	<i>Gnathostoma spinigerum</i>
<u><i>Naegleria fowleri</i></u>	<u><i>T. solium</i></u>	<i>S. japonicum</i>	<i>G. hispidum</i>
<i>Plasmodium falciparum</i>		<i>S. mekongi</i>	<i>Loa loa</i>
<i>Toxoplasma gondii</i>		<i>S. intercalatum</i>	<i>Strongyloides stercoralis</i>
<u><i>Trypanosoma brucei</i></u>			<i>Toxocara canis</i>
<i>gambiense</i>			<i>T. cati</i>
<u><i>T. brucei rhodesiense</i></u>			<i>Trichinella</i> spp.

Selected parasites that cause CNS infection in human

PARASITES OF CNS

➤ Helminths

✓ *Taenia spp.:*

1. *Cysticercosis (Taenia solium).*
2. *Coenurosis (Taenia multiceps).*

➤ Protozoa:

✓ Free living amoebae:

1. *Naegleria fowleri.*
2. *Acanthamoeba spp.*

✓ Trypanosomes: African trypanosoma.

Cysticercosis

Definition: Infection of human tissues by "*cysticercus cellulosae*", the larval stage of pork tapeworm *Taenia solium*.

- Human cysticercosis, occurs when man behaves as **intermediate host** for *T. solium*.

Geographical distribution

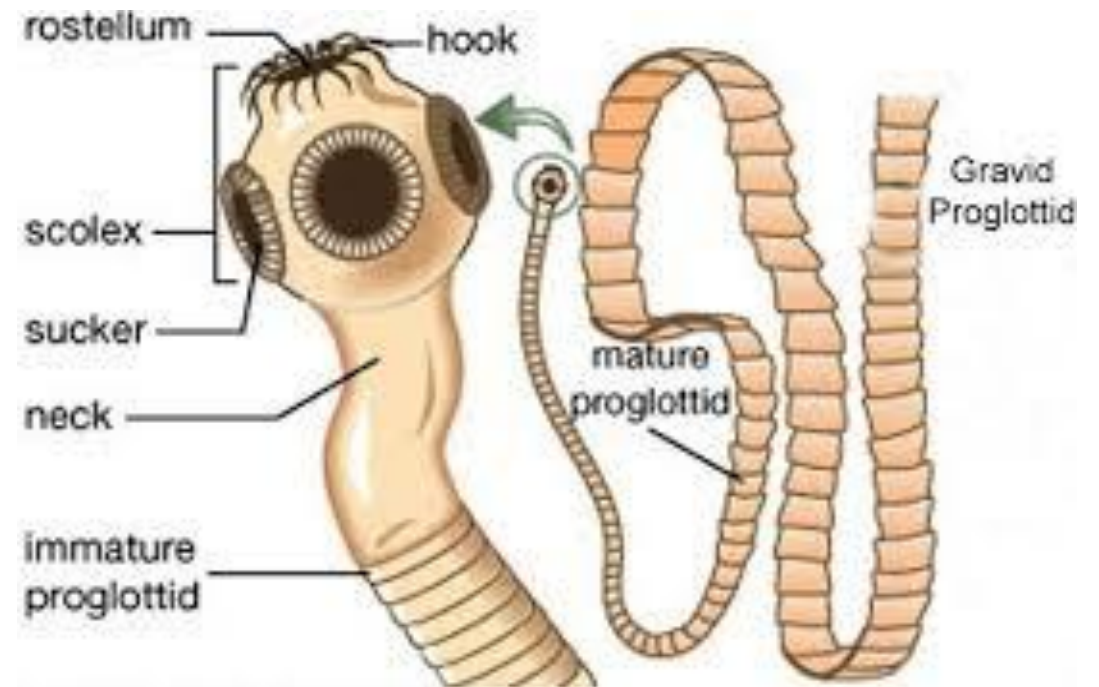
Cosmopolitan, where pigs are eaten .



Morphology

Adult:

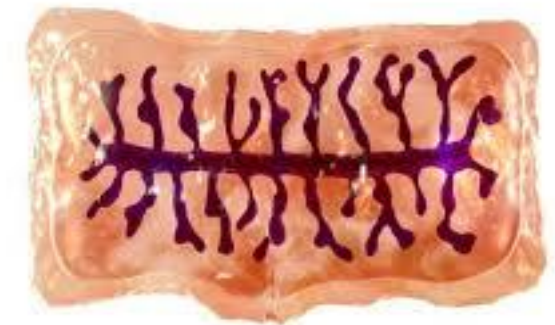
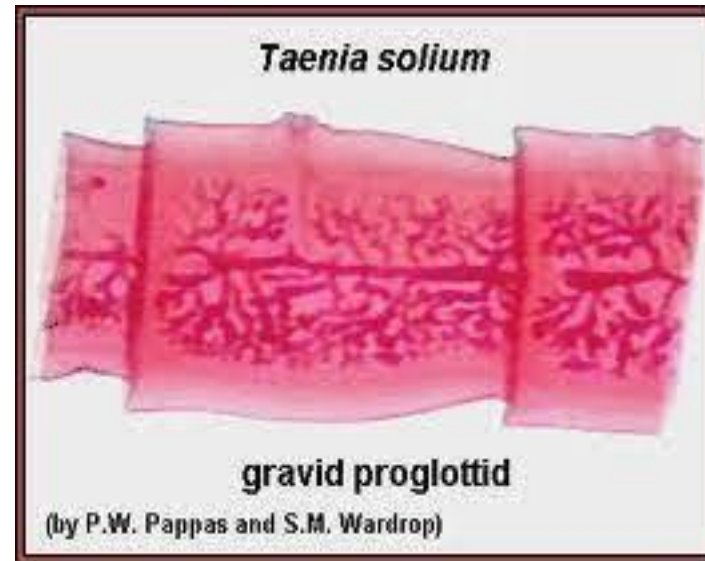
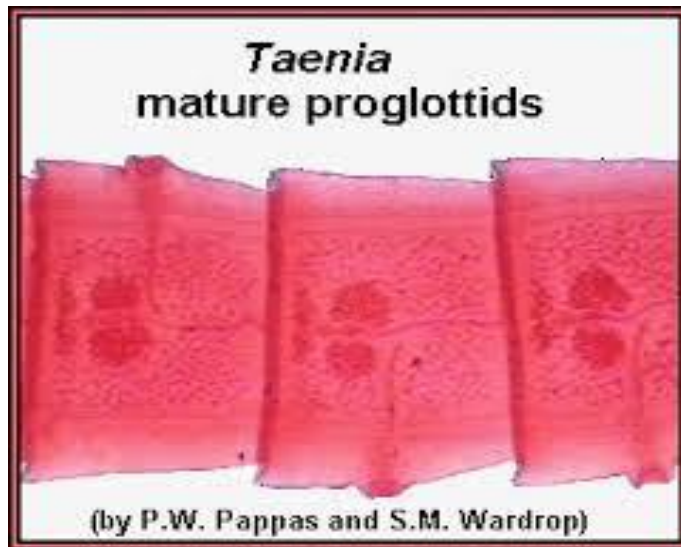
- The worm is 2-4 meters in length and has 800-1000 segments.



- The **scolex** is globular, equipped with four cup-shaped suckers and a rostellum with a double crown of hooks.



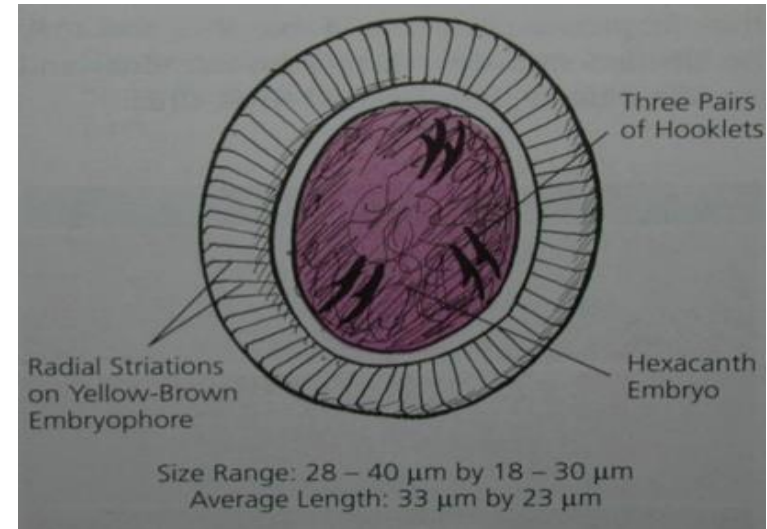
- The **mature proglottid** contains ovary & testes.
- The **gravid proglottid** contains gravid uterus with 7-12 thick lateral branches on each side of the main uterine stem.



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Egg stage

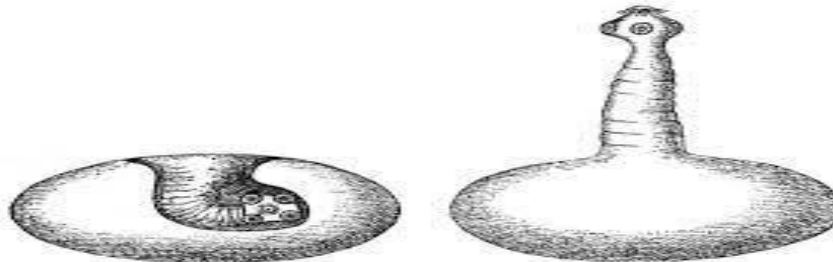
- **SIZE:** 30-40 μm ,
- **SHAPE:** spheroid has thick radially striated shell.
- **COLOR:** yellowish-brown,
- **CONTENTS:** hexacanth embryo (onchosphere).



Cysticercus cellulosae

It is soybean-like in shape, with the small scolex invaginated into the translucent cyst (left).

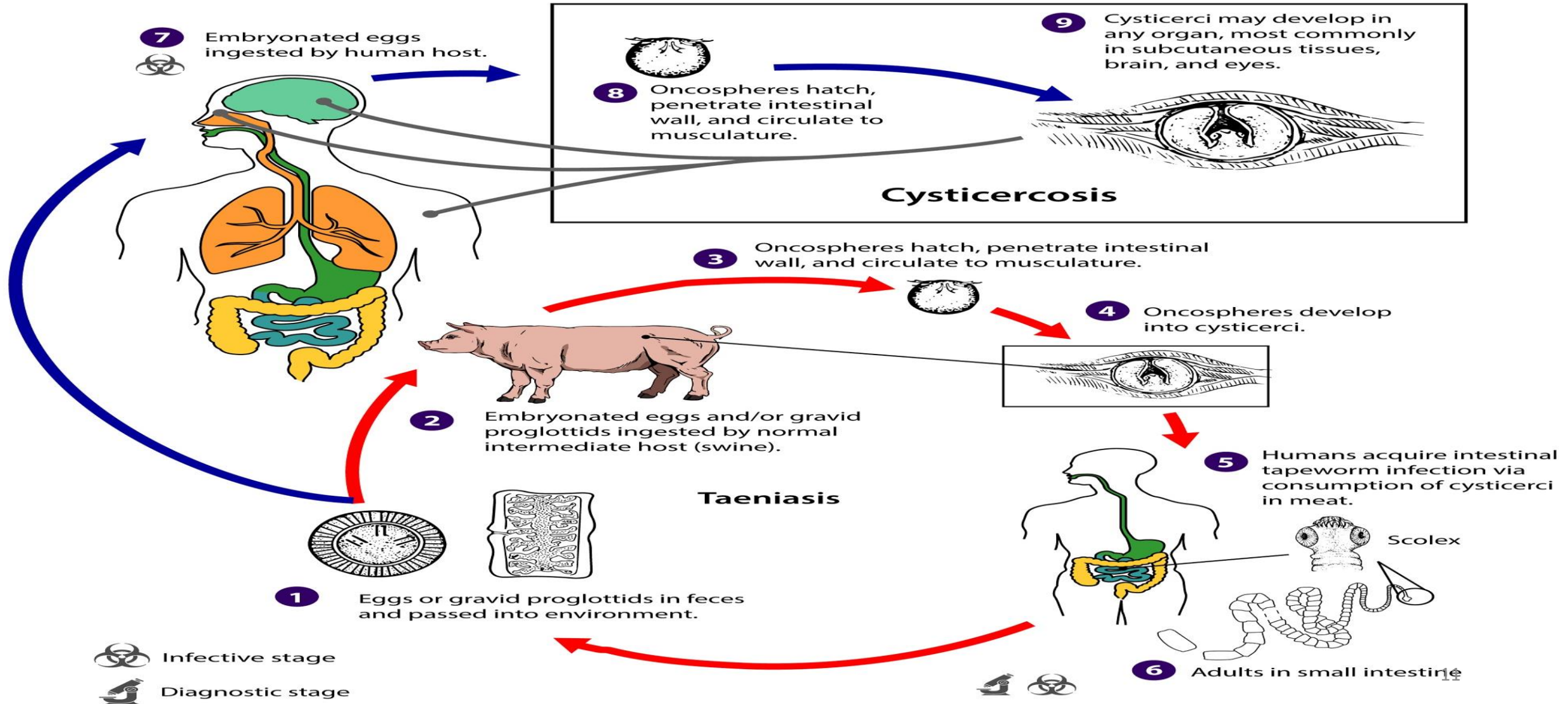
The scolex evaginated from the cyst (right).



Life cycle



Taenia solium



N.B.

- : After ingestion of eggs, the eggs hatch and liberate onchospheres in the intestine, the onchospheres penetrate the gut wall, carried by circulation to different tissues where they settle to form cysts (cysticerci).
- Individuals who ingest *T. solium* eggs develop tissue infection with cysts (cysticercosis).
- Individuals who ingest *cysticercous cellulosae* in pig meat acquire the adult form of *T. solium* (taeniasis).

Life cycle of *Taenia solium*

- 1-**Habitat:** Adult *Taenia solium* inhabits the upper part of the jejunum.
- 2-**Definitive host:** Man.
- 3-**Intermediate host:** Pig and occasionally man.
- 4-**Infective stage:** Eggs.

Mode of infection of cysticercosis

- 1- **Ingestion** of food and water contaminated with *T. solium* eggs.
- 2- **External autoinfection**: patient contaminates his hands with eggs discharged in his faeces i.e. (Foeco – oral transmission).
- 3- **Internal autoinfection**: regurgitation of eggs into the stomach by reverse peristalsis. On returning again to intestine, eggs hatch.
- **N.B.** autoinfection occurs in patients harboring adult *T. solium* worms in their intestines.

Pathology

- Cysticerci have been recovered from all areas of the body.
- The common sites are **CNS, subcutaneous tissue, skeletal muscle and eyes.**
- Cysticerci in the brain represent **the most frequent parasitic infection of human C.N.S.**
- Pathology can result from actual larval **invasion** of tissue (particularly the brain) and/or **death** of the organism, which stimulate tissue reaction around the larvae that may end by calcification.

Clinical picture

Neurocysticercosis (NCC):

- NCC is the most common form and accounts for 60–90% cases of cysticercosis.
 - It is considered as the most common parasitic CNS infection of man.
- It is the most common parasitic cause of adult onset epilepsy throughout the world.
- Sometimes NCC remains in the brain without causing any apparent symptoms.
 - Seizure is the most common manifestation (70% of cases).

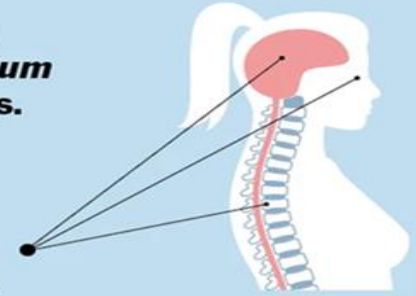


- ❖ Other features include
 - increased intracranial pressure.
 - Meningitis
 - Psychological disorders
 - Dementia.

Symptoms of Cysticercosis

You get cysticercosis from ingesting *T. solium* (pork tapeworm) eggs. They hatch and form cysts in your body.

Symptoms depend on where cysts form.



The most common symptoms are from cysts in the brain and spinal cord (neurocysticercosis), including:



Seizures.



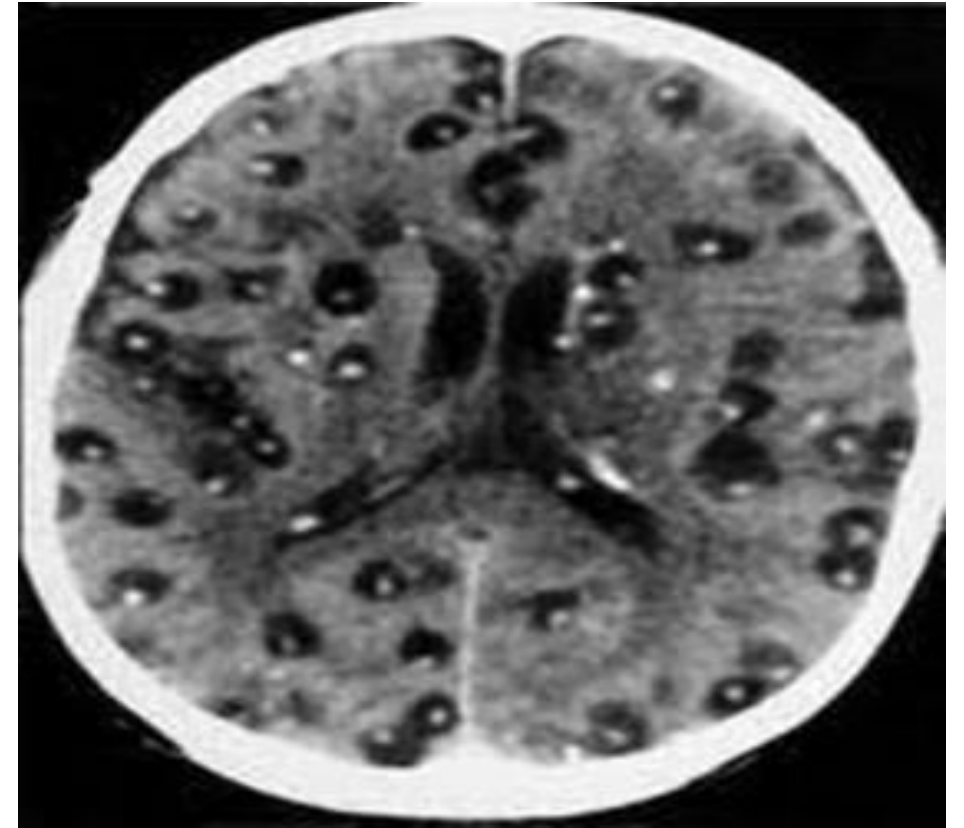
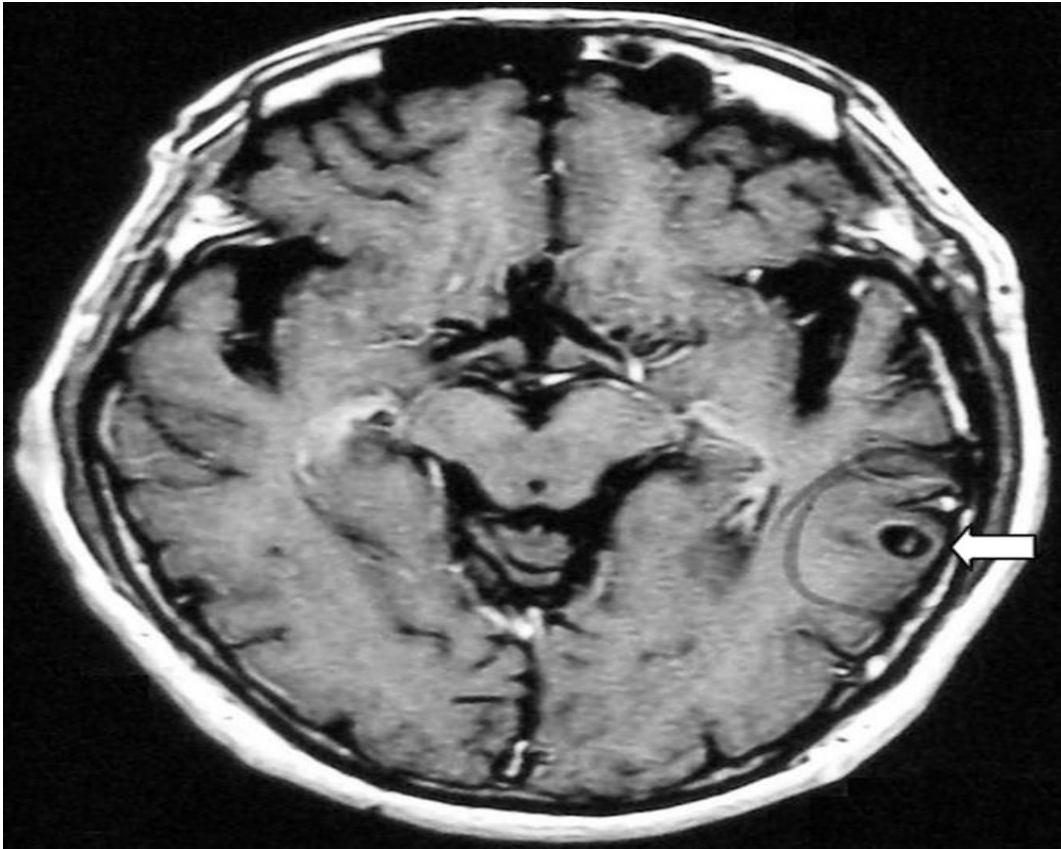
Headaches.



Nausea, vomiting and confusion (cysticercal encephalitis).



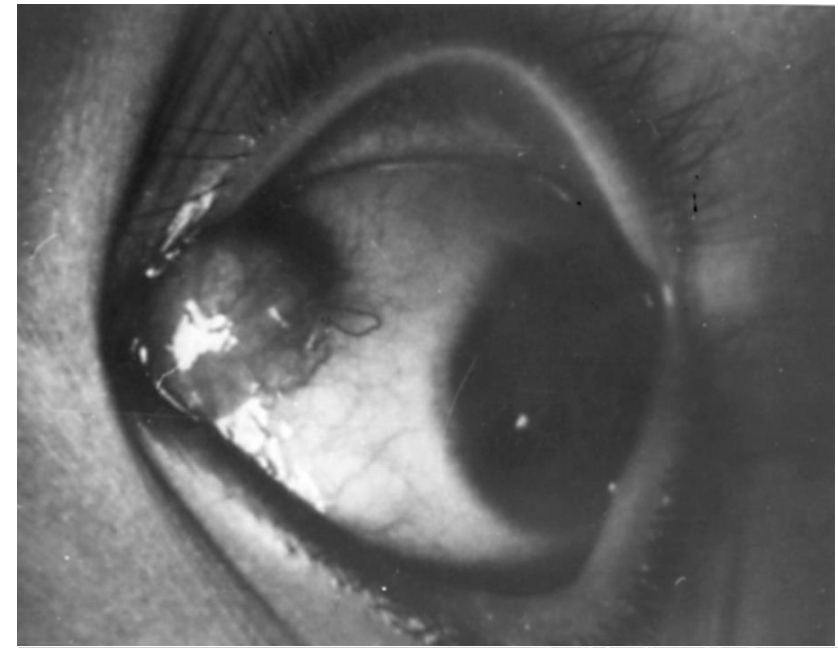
Stiff neck.



Axial magnetic resonance imaging scan (MRI) of the brain with neurocysticercosis showing a vesicular cyst (arrow). The head of the larva in the cyst gives the lesion a pathognomonic “hole-with-dot” appearance.

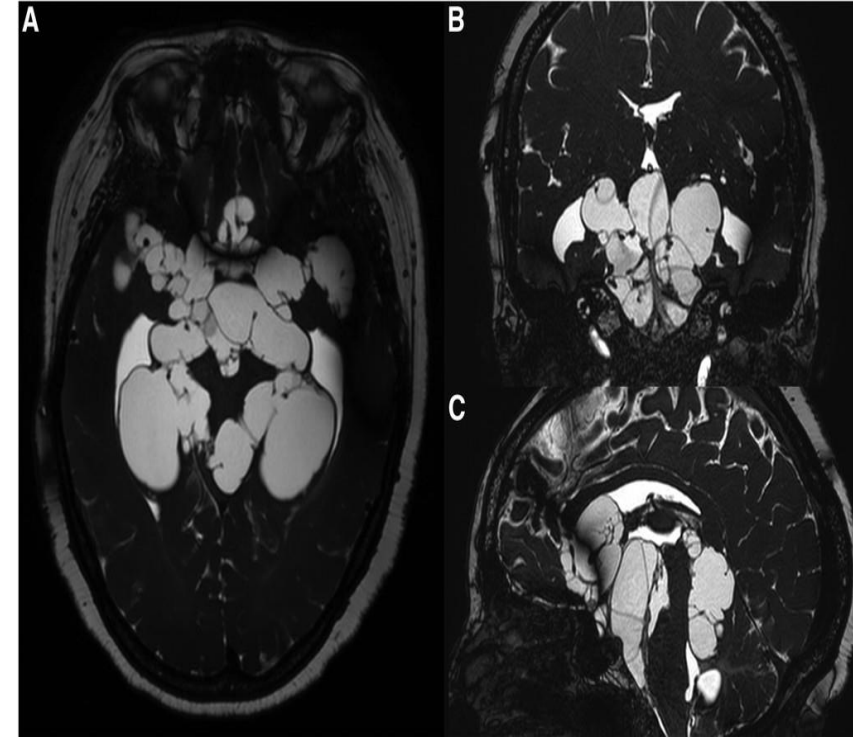
Ophthalmocysticercosis:

- The presenting symptoms are periorbital pain, flashes of light, blurred vision, and progressive deterioration of visual acuity.
- A larva in the subretinal space may cause haemorrhage and edema and/or retinal detachment.



Racemose cysticercosis:

This is a **proliferating** form of cysticercus, composed of several larvae connected together and is often found in the brain. the growth resembles that of a metastatic tumour.



Muscular cysticercosis:

- The cysts frequently **calcify** can lead to intramuscular nodules, usually accompanied by muscular pain, weakness.

Subcutaneous cysticercosis:

- Subcutaneous nodules are found; they reach 5 to 10 mm in size, and are fixed in position.

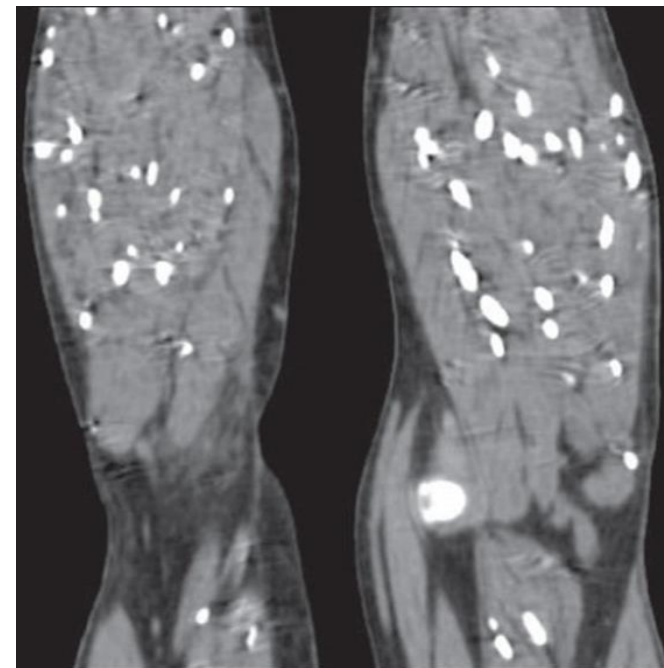
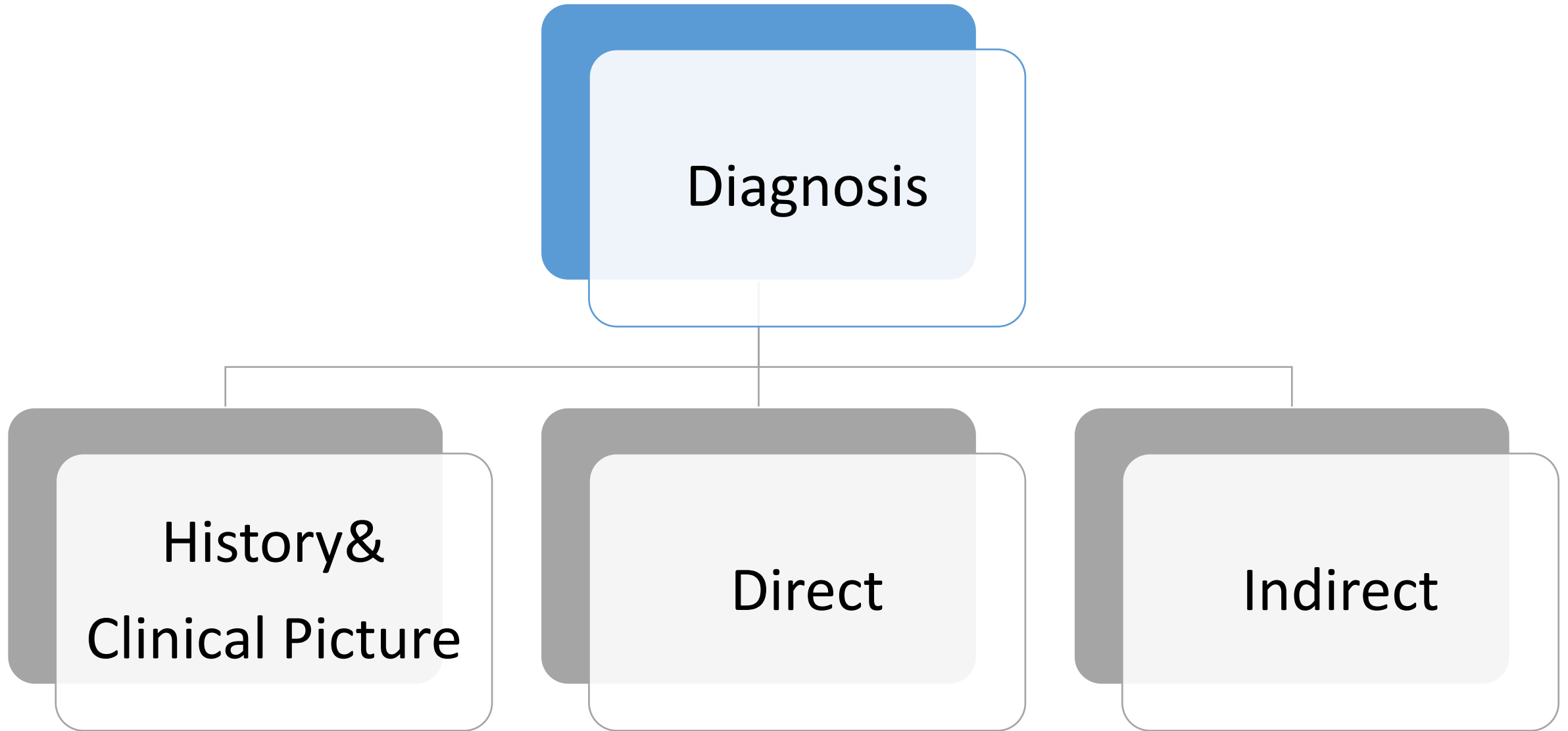


Figure 1. Clinical photograph showing a swelling (white arrow) over

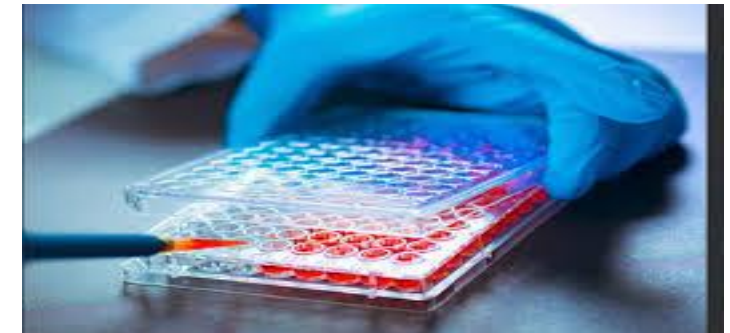
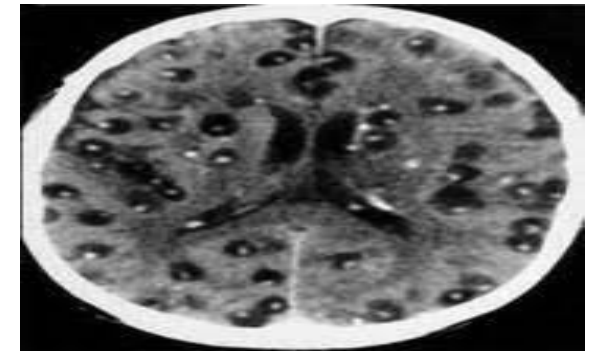
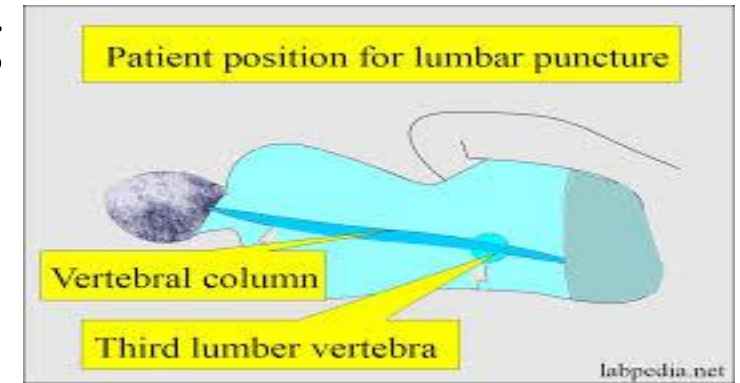


Diagnosis

- **History & Clinical picture:** The onset of epileptic seizures in a teen-ager or adult resided in endemic area.
- **Biopsy** from subcutaneous cysticerci.
- **Slitlamp examination:** In the eye the larva may be detected by ophthalmoscope.



- **Examination of cerebrospinal fluid (CSF):** showing Elevated proteins, significant reduction in glucose, increase in mononuclear cells and eosinophils.
- **Radiologic examination** using computed tomography (CT) scans and magnetic resonance imaging (MRI).
- **Serodiagnostic techniques:** e.g. Western blotting, IHA and ELISA tests. The best test is a “western blot”.



Treatment

Medical treatment:

- **Antiparasitic drugs:** Praziquantel or albendazole may be used for brain lesion.
- **Steroids:** are often given with either of these drugs to control symptoms secondary to the inflammatory response to killed larvae.

- **Surgical treatment** is indicated for:

- Ocular.
- Muscular and subcutaneous lesions.
- Cases not responding to medical treatment.

Prevention



- Good personal hygiene to prevent autoinfection with eggs.
- Effective fecal disposal to prevent contamination of food and water with eggs.
- Proper treatment and prevention of human intestinal infections.



Coenurosis Cerebralis (*Taenia multiceps*)

Disease

Coenurosis.

Geographical distribution

Worldwide, particularly in **sheep raising countries.**

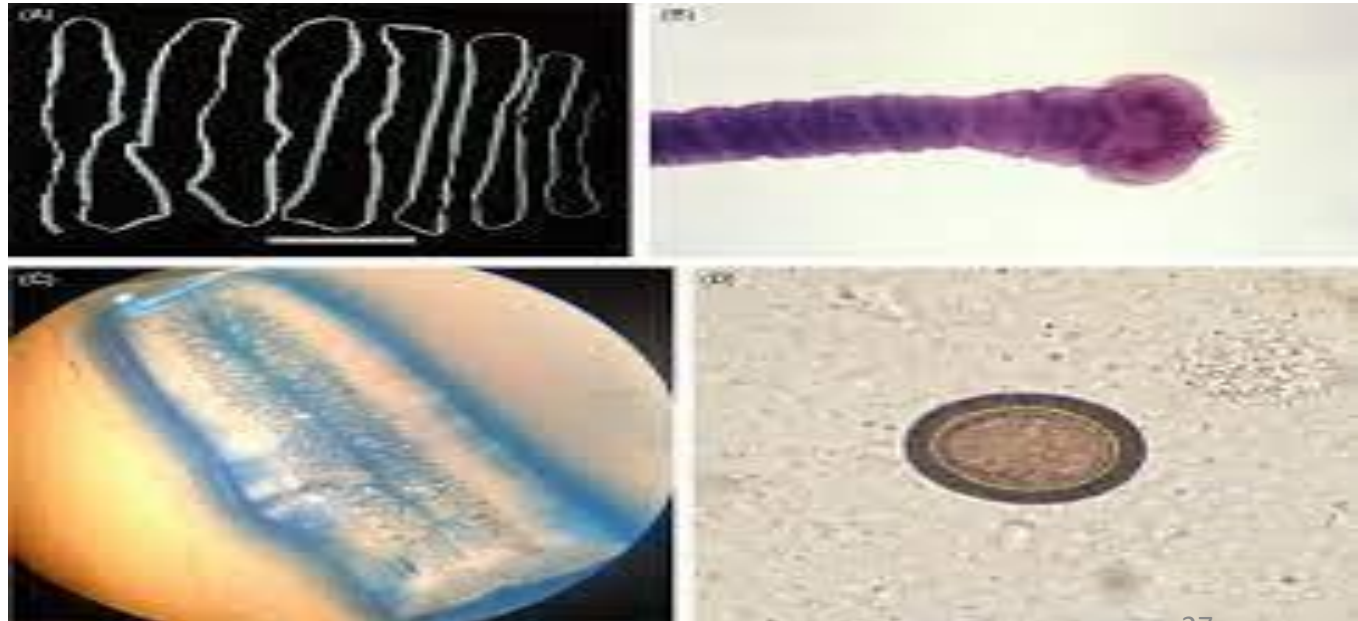


Morphology

1-Adult:

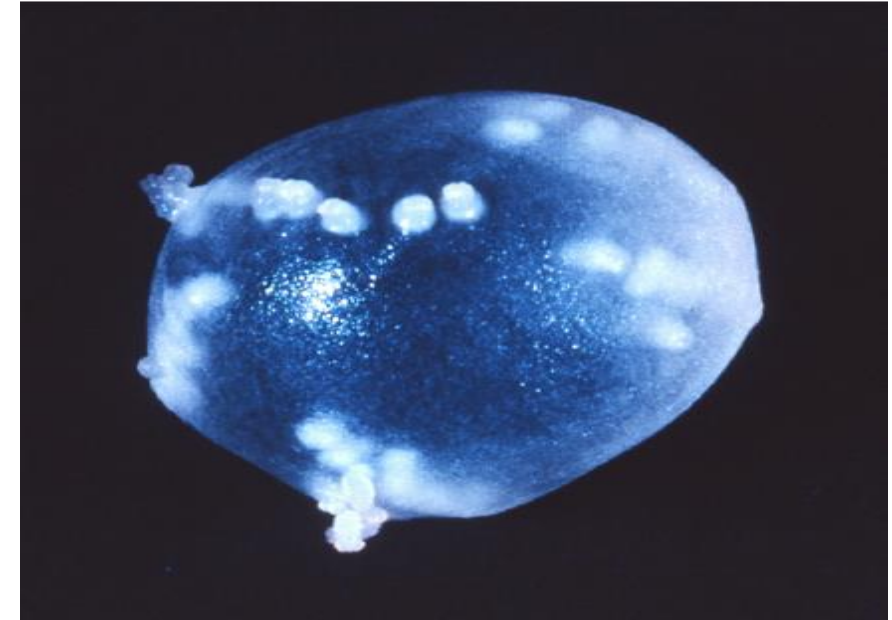
- It is 50-100 cm in length with proglottids.
- Has a globular scolex with double crown of large and small hooks.

2-Egg: *Taenia* Like.



3-Coenurus larva:

- Globular to ovoid fluid filled cysts, from 2 to 10 cm in size.
- Have thin transparent wall and inner delicate germinal membrane; contain multiple invaginated small scolices that arise from the germinal wall.

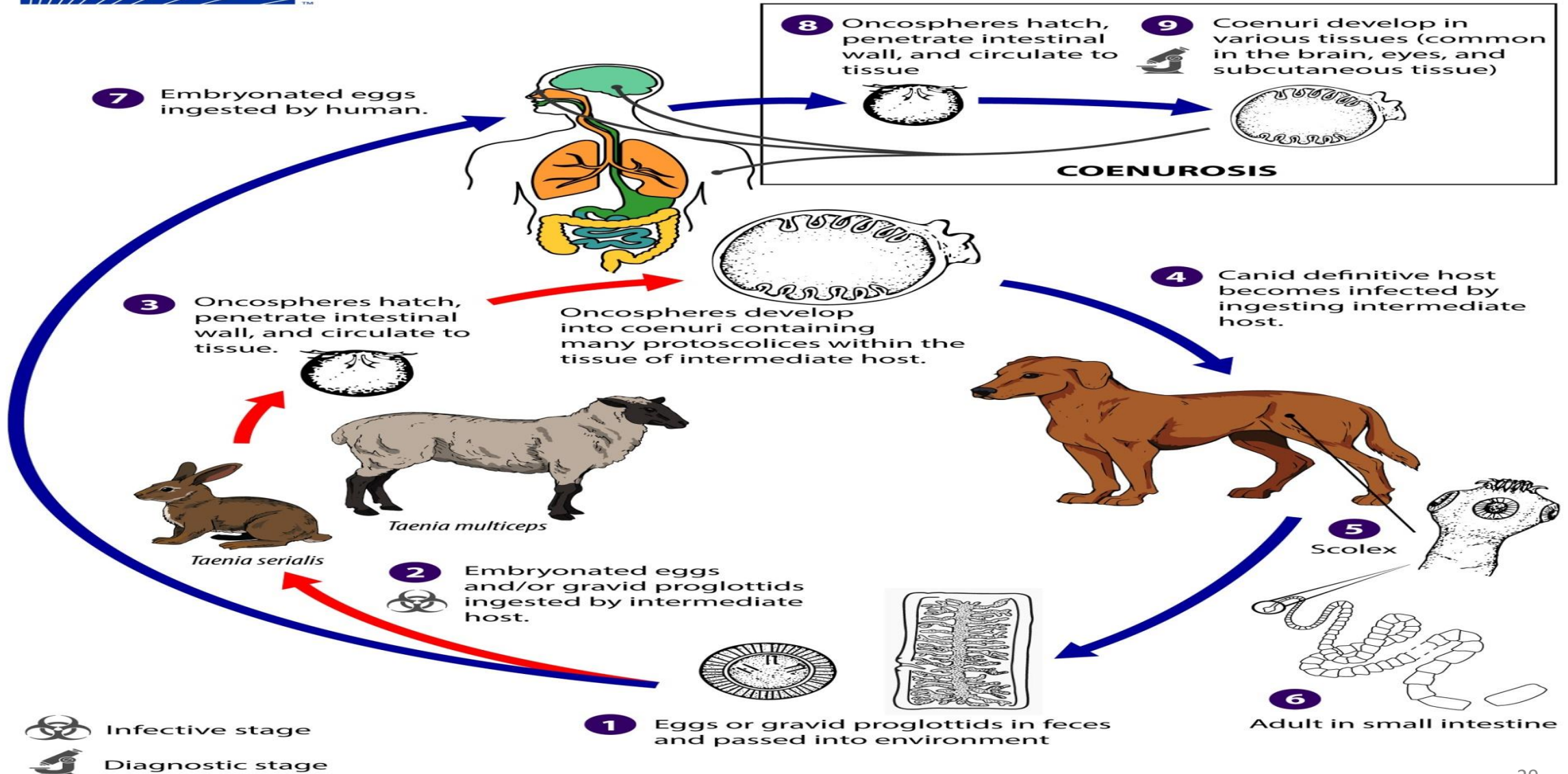


Coenurus cyst after surgical removing from the eye

Life cycle



Coenurosis



Life cycle

1-Habitat: Intestines of dogs and wild canines.

2-Definitive host: Dogs and wild canines.

3-Intermediate host: Herbivores, rodents and occasionally man.

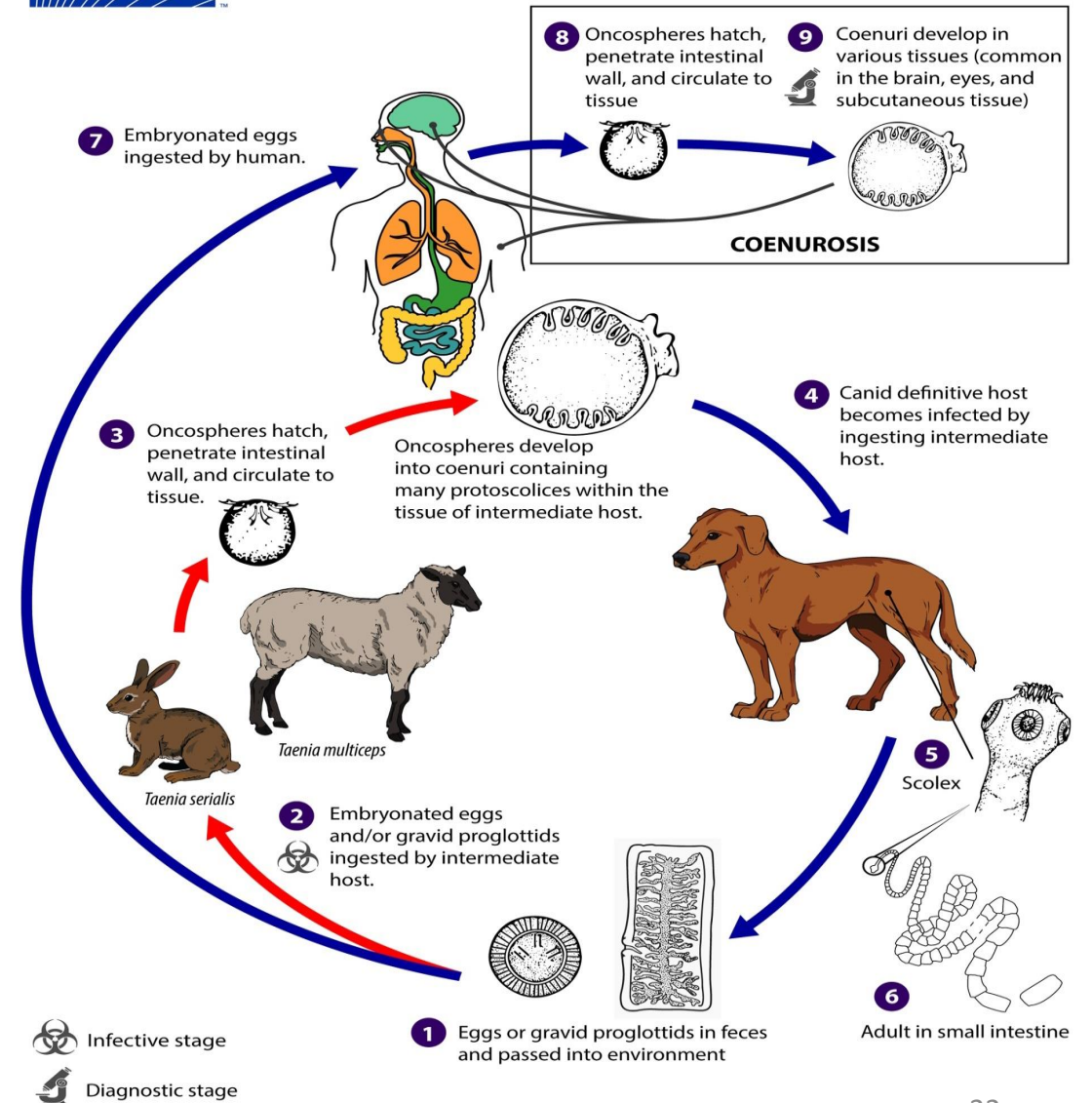
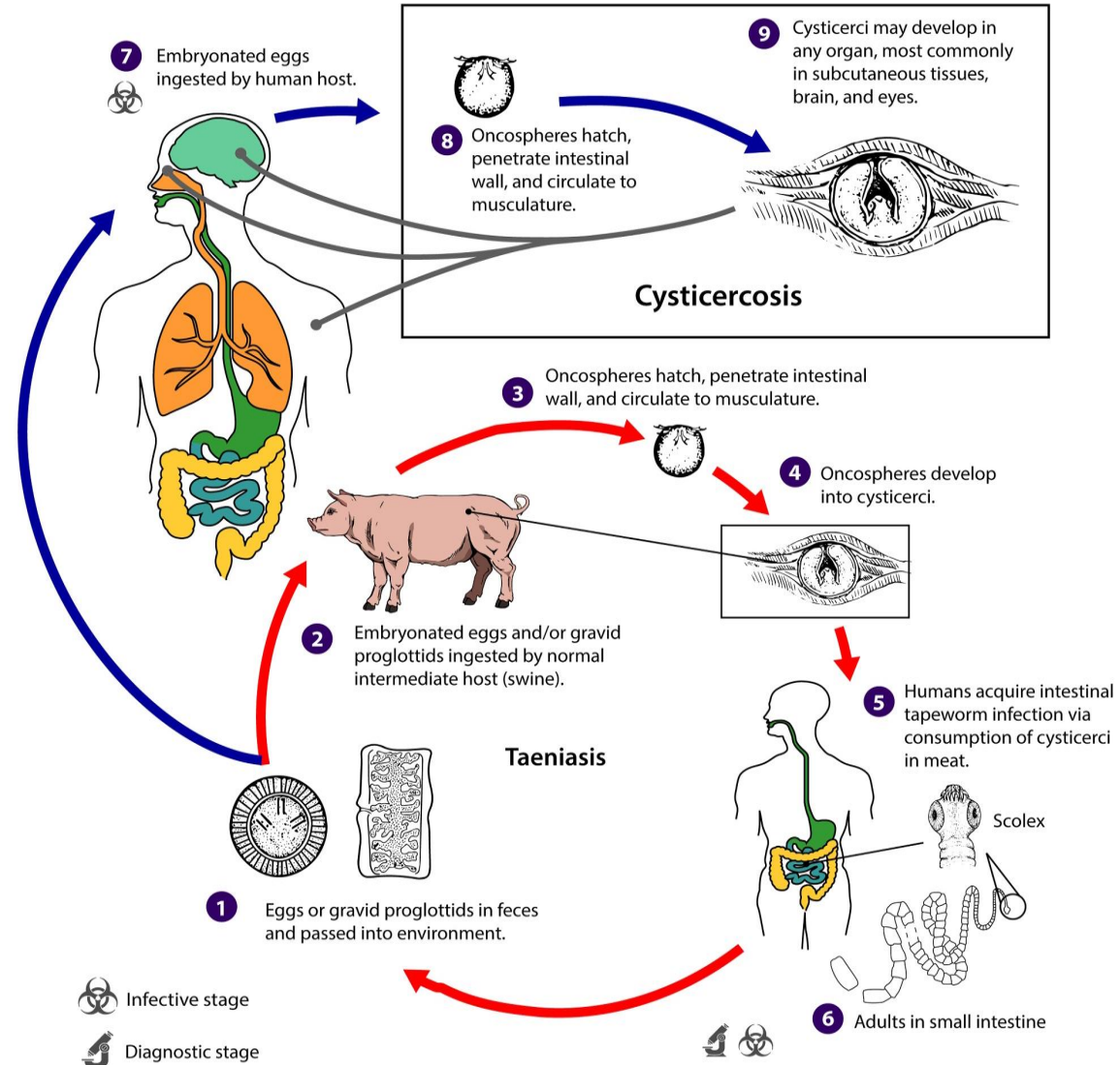
4-Infective stage: Eggs.

5-Mode of infection: Man becomes infected by ingestion of eggs.

Life cycle

- The life cycle of *multiceps* spp. is similar to that of *Taenia solium*.
- *Coenuri* develop mainly in the central nervous system.

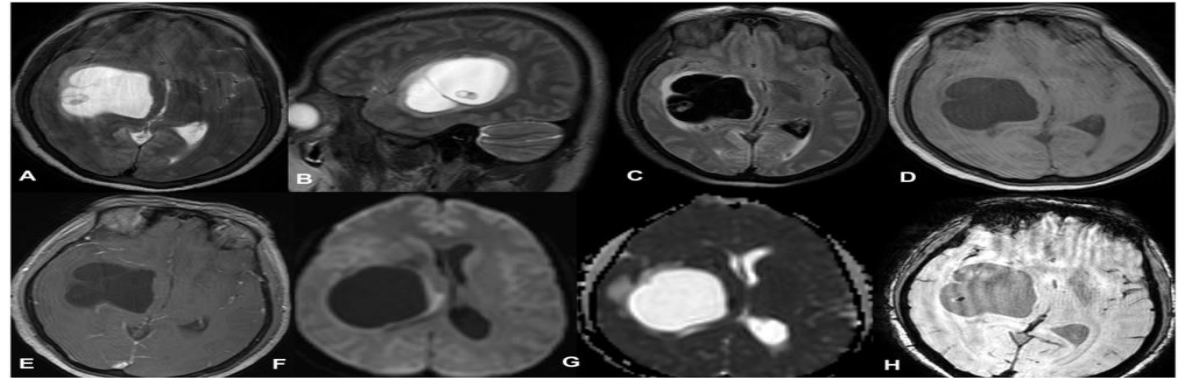




	<i>Taenia solium</i>	<i>Taenia multiceps</i>
Habitat	Adult inhabits the intestine of man.	Adult inhabits intestines of dogs and wild canines
Definitive host	Man	Dogs and wild canines
Intermediate host	Pig and occasionally man	Herbivores, rodents and occasionally man.
Infective stage	Eggs \ cysts	Eggs
Mode of infection	Man becomes infected by ingestion of eggs\ cysts.	Man becomes infected by ingestion of eggs.

Clinical picture

- The manifestations resemble that of **space occupying lesions**, including headache, vomiting, paraplegia, hemiplegia, aphasia, seizures.



- Ocular manifestations are reported after eye infection.

- **Diagnosis:** By surgical recovery of larva.
- **Treatment:** Surgical removal if possible.
- **Prevention:** Protection of food and hands from dog feces.



QUIZ TIME

1-The Definitive host of *Taenia multiceps* is

- a. Sheep**
- b. Dogs**
- c. Man**
- d. Pigs**

2- The intermediate host of *Taenia multiceps* is

- a. Sheep**
- b. Dogs**
- c. Fish**
- d. Pigs**

1-Habitat of *Taenia solium* is

- a. Intestine**
- b. Brain**
- c. Muscles**
- d. Lung**

The most frequent parasitic infection of human C.N.S. is.....

- a. Amoebiasis**
- b. Cysticercosis**
- c. Coenurosis**
- d. Schistosomiasis**

5-The most common manifestation of neurocysticercosis is....

- a. Cardiomyopathy
- b. Dementia
- c. Gastroenteritis
- d. Seizure

6-The most common parasitic cause of adult-onset epilepsy throughout the world is.....

- a. Amoebiasis
- b. Cysticercosis
- c. Coenurosis
- d. Schistosomiasis

7-Coenurosis is caused by Ingestion of.....

- a. Eggs of *Taenia solium*
- b. Larvae of *Taenia solium*
- c. Eggs of *Taenia multiceps*
- d. Larvae of *Taenia multiceps*

8-The definitive host of *Taenia solium* is

- a. Sheep
- b. Dogs
- c. Man
- d. Pigs



1- List 8 parasites that can affect CNS.

2- Compare in a table between *Taenia solium* and *Taenia muliceps* regarding; Habitat, DH, IH, infective stage, diagnostic stage, mode of infection.

Reference

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MEDICAL PARASITOLOGY Elsevier June 1, 2021

Recommended :

2-Textbook_of_MEDICAL_PARASITOLOGY

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THANK YOU

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